

## CHAPTER 15

### INDUSTRIAL WATER SUPPLY SYSTEMS

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#### 15-1. Minimum maintenance activities for industrial water supply systems

The tables located at the end of this chapter indicate items that must be performed to maintain systems and equipment at a minimum level of operational readiness. The listed action items should be supplemented by manufacturer-recommended maintenance activities and procedures for specific pieces of equipment. Maintenance actions included in this chapter are for various modes of operation, subsystems, or components. Table 15-1 provides maintenance information for vertical turbine pumps. Table 15-2 provides maintenance information for general system maintenance. Table 15-3 provides maintenance information for industrial water supply system instrumentation and electrical.

#### 15-2. General maintenance procedures for industrial water supply systems

This section presents general instructions for maintaining the types of components associated with industrial water supply systems.

*a. Plate and frame heat exchanger maintenance.* Since heat exchangers have no moving parts, heat exchanger maintenance problems generally result from poor water quality and lack of proper water treatment. Another cause of maintenance problems is temperature and pressure cycling as equipment is started and stopped. Heat exchangers are subject to fouling or scaling. A light sludge or scale coating on heat transfer surfaces can greatly reduce the effectiveness of the heat exchanger. This loss of performance may show up as higher than design temperatures or higher than design pressure drops through the heat exchanger unit. Units require periodic cleaning to maintain performance.

(1) The interior plates of the heat exchanger can be cleaned by the following methods.

(a) Open the unit in accordance with manufacturer's instructions.

(b) Each plate should be cleaned separately. Depending on the amount of cleaning to be performed, the plate can be cleaned while still hanging in the unit or removed and placed on a flat surface and cleaned.

(c) **Never use a steel brush or steel wool on the plates.** If a brush is required, a fiber type is recommended. If iron is forcibly rubbed on a stainless steel surface, it is impossible to remove all imbedded particles and will result in accelerated rusting and/or corrosion. If it is absolutely necessary that a steel brush be used, a brush material compatible with the plate material, such as stainless steel, is recommended.

(d) Be careful not to scratch the gasket surfaces.

(e) After brushing, each plate should be rinsed with clean water.

(f) **The gaskets must be wiped dry with a dry cloth.** Solid particles adhering to the gaskets can cause damage and may result in leakage when the unit is put back in operation.

(g) The lower portion of each plate should be inspected carefully and cleaned appropriately as this is the primary area where residual solid material tends to accumulate.

(h) Wipe off the mating surface, i.e., the rear of the plate where the gasket seats.

(i) Upon completion of cleaning and final inspection of each plate, the unit may be closed and tightened per manufacturer's assembly drawing and tightening instructions, and put back into operation.

(j) Precipitates of calcium compounds from cooling water and other sources can be removed by wetting the plate at room temperature with a solution of nitric acid [1 volume concentrated Nitric Acid (specific gravity 1.41) to 9 volumes of water]. Let stand for approximately 5 to 10 minutes, water rinse, and then fiber brush. If necessary, repeat this operation several times. An alternate cleaner is Oakite 131 (inhibited phosphoric acid) at up to 150°F. Upon completion of acid treatment, neutralize with a dilute caustic solution followed by a clean water rinse. If the above methods are not effective, there are many commercial chemical cleaning programs available. Carefully follow the manufacturer's instructions as these programs generally use an acid or caustic wash that must be neutralized to prevent long-term attack on heat transfer surfaces or interference with water chemical treatment programs.

(2) When opening or disassembling a heat exchanger for inspection or maintenance, observe the following.

(a) The pressure of both liquids should be simultaneously decreased gradually when shutting down the unit.

(b) Exercise care in handling plates to avoid damage. Do not handle plates with hooks or other sharp tools which might cause damage. A skid, cradle, or other protective device should be used when available.

(c) Thoroughly clean plates at each cleaning. Leaving any film on the plates only decreases the time interval to the next cleaning. Wire brushes and scrapers may be used to assist in cleaning the cooling water (usually the outside) of tubes. Exercise care to minimize damaging the tube surfaces.

(d) Inspect plates for damage and repair as required.

(e) When reassembling the unit, do not tighten bolts on gasketed connections until the gaskets have been properly seated. Replacing the gaskets when the unit is reassembled can eliminate having to schedule another shutdown to replace a leaking gasket. Composition gaskets become brittle and dried out and do not provide an effective seal when reused. Metal or metal jacketed gaskets when compressed initially tend to match the gasket contact surfaces and become work-hardened. When reassembled, the joint may not make up the same and a work-hardened gasket will not conform to the mating surfaces. The joint may leak and the mating surfaces may be damaged.

(f) When a new or repaired unit is placed in service, frequently inspect all gasketed joints during the first two days of operation for leaking joints or loose bolts. Tighten and adjust as required.

b. *Test alarms.* Verify operation of system alarms and alarm system by actuating appropriate system test push buttons. Verify that the audible alarm sounds and that all warning and annunciator lights operate.

c. *Rotating equipment clearance adjustment.* After long service, the running clearances in some types of rotating equipment (fans, pumps, compressors, etc.) may increase to the point where the device is

losing capacity or pressure. Resetting the clearances will normally improve performance. Check clearances during annual inspections and adjust as required. Refer to the manufacturer's technical service manual.

*d. Examine internal parts of rotating equipment.* Periodically (at least annually) remove casing access covers and inspect components for wear. Replacing a relatively inexpensive part after only moderate wear can eliminate the need to replace more expensive parts at a later date. Refer to manufacturer's technical service manual.

*e. Clean all equipment.* Clean all equipment regularly. Clean equipment is easier to inspect, lubricate and adjust. Clean equipment also runs cooler and looks better.

Table 15-1. Vertical turbine pumps

<b>Vertical Turbine Pumps</b>	
<i>Action</i>	<i>Frequency</i>
<b>Pumps (Not Operating)</b>	
Tighten or replace loose, missing, or damaged nuts, bolts, or screws.	yr
Remove rust or corrosion with a fine wire brush and rags. Clean all parts, except electrical contacts, by moistening a cloth or brush with a suitable solvent.	6 mos
Lubricate motor bearings.	6 mos
Grease guide bearings. Clean all dirt from fittings and remove relief plugs. Purge bearings using a low pressure grease gun until new grease appears at relief hole.	6 mos
Check electrical insulation for cracks, cuts, and abrasions.	6 mos
<b>Pumps (Operating)</b>	
Observe and record suction and discharge pressures.	yr
Observe and record electrical load data on motor when under full load.	yr
Replace mechanical pump seal.	yr
While pump is running, inspect for proper rotation, vibration, noise, output, etc.	6 mos
Ensure pump does not run backwards when it shuts off. This will indicate if the check valve is functioning properly.	6 mos
Check automatic operation of pump.	6 mos
<b>Industrial Reservoir</b>	
Check residual chlorine level in the industrial reservoir. Should be approximately 1 ppm. Add chlorine as required, or drain reservoir and add fresh water until residual chlorine level is approximately 1 ppm.	day

Table 15-2. General system maintenance

General System Maintenance	
<i>Action</i>	<i>Frequency</i>
<b>General</b>	
Inspect entire industrial water system for the following:	
Leaking pipe joints and/or corrosion.	mo
Torn or missing identification tags.	mo
Proper pipe support (sagging or misalignment).	mo
Condition of flexible joints.	mo
<b>Valves</b>	
Exercise all valves:	
Grease stems on os&y valves.	mo
Inspect packing gland and tighten if necessary.	mo
<b>Control Valves</b>	
Check for correct positioning and operation of control valves.	yr
Check for leaking seals.	yr
Wipe valve operator rods clean and apply coat of light oil.	yr
Adjust operator linkages and limit switches as required.	yr

Table 15-3. Industrial water supply system instrumentation and electrical

<b>Industrial Water Supply System Instrumentation &amp; Electrical</b>	
<i>Action</i>	<i>Frequency</i>
<b>Pneumatic Control Systems</b>	
Check for air leaks in joints of piping and at control devices using soapy water, with control air compressor operating. Repair or replace parts as required.	3 mos
Check the contact surfaces and condition of all transmitters, sensing elements, temperature indicators, and pressure gauges.	3 mos
Check the operation of all control devices.	yr
Calibrate all controllers as recommended by the manufacturer of the control. Set the control point(s), sensitivity, range, proportional band, etc., to the correct values.	yr
Check the calibration of all transmitters, sensing elements, switches (temperature, pressure, flow, etc.), time delay relays, temperature and pressure indicators, and recorders. Clean, repair, or replace parts as needed. Calibrate the devices as necessary according to the manufacturer's instructions. Set the cut-in and cut-out points of all switches and time delay relays to the right value.	yr
<b>Electronic and Electric Control Systems</b>	
Check the main control panels for broken or frayed wires or loose connections.	3 mos
Check the contact surfaces and condition of all transmitters, sensing elements, temperature indicators, and pressure indicators.	3 mos
Check the contact and switch points in motor starters, relays, and switches to be sure that they are clean and meet properly. Clean or replace contacts and switches as needed.	6 mos
Check the operation of all control devices.	yr
Calibrate all controllers as recommended by the manufacturer of the control. Set the control point(s), sensitivity, range, etc., to the correct setting.	yr
Check the calibration of all transmitters, sensing elements, switches (temperature, pressure, flow, etc.), time delay relays, temperature and pressure indicators, and recorders. Clean, repair, or replace parts as needed. Calibrate the devices as necessary according to the manufacturer's instructions. Set the cut-in and cut-out points of all switches and time delay relays to the right value.	yr
<b>Motors</b>	
Check and clean cooling airflow passages on electric motors as necessary so that nothing obstructs airflow.	6 mos
<b>All Electrical Devices</b>	
Check, clean, and tighten terminals at motors, starters, disconnect switches, etc.	6 mos

Table 15-3. Industrial water supply system instrumentation and electrical (continued)

Industrial Water Supply System Instrumentation & Electrical	
<i>Action</i>	<i>Frequency</i>
<b>Wiring</b>	
Check insulation on conductors in starters, switches, and junction boxes at motors for cracks, cuts, or abrasions. Replace wiring as required and correct cause of damage.	6 mos